High Speed Spectroscopic Ellipsometry Technique for On-Line Monitoring in Large Area Thin Layer Production

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Macro imaging spectroscopic ellipsometers has been developed for high speed mapping of large area thin layer coated substrates. Non-contact and non-destructive characterization techniques based on spectroscopic ellipsometry are widely used by the photovoltaic and semiconductor industry for process or quality control in production. The commercialization of large area thin film technologies and the related increasing surfaces lead to many key problems such as reduced efficiency caused by multiple non-uniformities of the layer properties over the entire panel or wafer resulting from the technological steps of individual layer components. For these reasons, thin layer properties must be mapped by an „in-line" or „in-situ" method avoiding mistakes resulting from layer inhomogeneities. Scanning ellipsometry methods based on the conventional narrow beam spectroscopic measurements provide high accuracy but suffer from long mapping times as the polarization state of the reflected beam must be detected. **Expanded beam ellipsometry** was developed to measure rapidly the polarization state changes after reflection from bigger surfaces. Our instruments use non-collimated illumination with a special light source and an optical arrangement allowing multiple angles of incidence [1]. New prototypes have been prepared for spectroscopic measurements that provide a **line image of spectroscopic ellipsometry** data with a lateral resolution of ~10 mm over the range of 350-1000 nm [2-4]. Ellipsometric information of large areas can be collected a **couple of 10 times faster** compared to scanning methods. Prototypes have been built for structures with nominal widths of 300-450-600-900 mm (SiO2, ZnO/Mo, NiSi) **on rigid substrates**. Thin layers (ZnO/a-Si:H/Ag) on plastic foil substrates were also investigated **in roll to roll operation**. Measurements and results of different structures are presented.

We can demonstrate spectroscopic ellipsometry mapping measurements over 1800 points in ~1 min traverse of a 300-450 mm diameter Si-wafer (demonstration in clean room environment, see Fig. 1) or 600x1200 mm solar panel.

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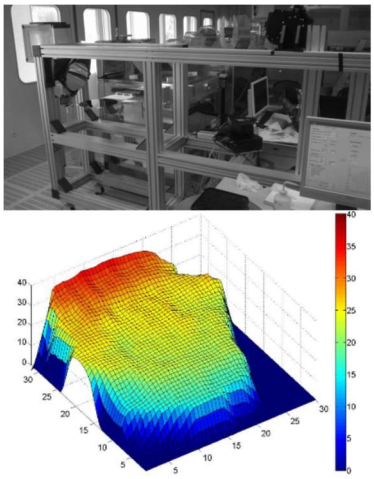

Fig. 1. Installed mapping device and thickness-map of a NiSi covered 300 mm diam. Si-wafer (complete annealing at 350° C).

Keywords: Mapping; ellipsometry, thin film

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